

**What is claimed is:**

1        1. A discharge lamp circuit for ignition time control  
2 and overvoltage protection, comprising:  
3        drive circuitry for producing a strike voltage for a  
4        discharge lamp and providing a lamp current  
5        through the discharge lamp;  
6        a sensing circuit for detecting the lamp current;  
7        a timing circuit, controlled by the sensing circuit,  
8        for developing a threshold voltage at the end of  
9        a predetermined period, thereby controlling an  
10       ignition time of the drive circuitry; and  
11       a start-up circuit for allowing the drive circuitry to  
12       keep on applying the strike voltage for the  
13       ignition time in order to start the discharge  
14       lamp before the threshold voltage is developed,  
15       and for causing the drive circuitry shutdown if  
16       the sensing circuit detects the absence of the  
17       lamp current.

1       2. The discharge lamp circuit as recited in claim 1,  
2 wherein the timing circuit comprises a capacitor coupled to  
3 a resistor at a node where a node voltage is developed, in  
4 which the predetermined period is determined by the  
5 capacitor's value and the resistor's value and the node  
6 voltage reaches the threshold voltage at the end of the  
7 predetermined period.

1       3. The discharge lamp circuit as recited in claim 2  
2 wherein the start-up circuit comprises a first switch

3 coupled to the node of the timing circuit, receiving an  
4 input signal, and generating a start signal at a first level  
5 to activate the drive circuitry when a voltage difference  
6 between the input signal and the node voltage is sufficient  
7 to turn on the first switch.

1        4. The discharge lamp circuit as recited in claim 3  
2 wherein the sensing circuit comprises a second switch  
3 coupled to the capacitor, when the sensing circuit detects  
4 the presence of the lamp current, the second switch is  
5 turned on to discharge the capacitor.

1        5. The discharge lamp circuit as recited in claim 4  
2 wherein the second switch is turned off when the sensing  
3 circuit detects the absence of the lamp current, thereby  
4 allowing the capacitor to be charged so that the node  
5 voltage reaches the threshold voltage at the end of a  
6 predetermined period.

1        6. The discharge lamp circuit as recited in claim 5  
2 wherein the start-up circuit generates the start signal at a  
3 second level to shut down the drive circuitry when the  
4 second switch is turned off, causing the first switch to be  
5 turned off.

1        7. The discharge lamp circuit as recited in claim 6  
2 wherein the start-up circuit further comprises a third  
3 switch coupled to the capacitor, for discharging the  
4 capacitor quickly upon the drive circuitry shutdown.

1        8. A discharge lamp circuit for ignition time control  
2 and overvoltage protection, comprising:

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3       drive circuitry for producing a strike voltage for a  
4            discharge lamp and providing a lamp current  
5            through the discharge lamp;  
6       a sensing circuit coupled to the discharge lamp, for  
7            detecting the lamp current;  
8       a timing circuit for developing a threshold voltage at  
9            the end of a predetermined period, comprising:  
10           a resistor; and  
11           a capacitor coupled to the sensing circuit and  
12           coupled to the resistor at a node where a  
13           node voltage is developed;  
14       wherein the node voltage reaches the threshold  
15           voltage at the end of the predetermined  
16           period determined by the capacitor's value  
17           and the resistor's value, thereby  
18           controlling an ignition time of the drive  
19           circuitry; and  
20       a start-up circuit comprising a first transistor  
21           coupled to the node of the timing circuit,  
22           wherein the first transistor is in a first state  
23           before the node voltage is developed into the  
24           threshold voltage thereby allowing the drive  
25           circuitry to keep on applying the strike voltage  
26           for the ignition time in order to start the  
27           discharge lamp, and the first transistor is in a  
28           second state when the sensing circuit detects the  
29           absence of the lamp current and the threshold  
30           voltage is developed at the end of the  
31           predetermined period.

1        9. The discharge lamp circuit as recited in claim 8  
2 wherein the start-up circuit receives an input signal and  
3 generates a start signal at a first level to activate the  
4 drive circuitry when a voltage difference between the input  
5 signal and the node voltage is sufficient to drive the first  
6 transistor into the first state.

1        10. The discharge lamp circuit as recited in claim 9  
2 wherein the sensing circuit comprises a second transistor  
3 coupled to the capacitor, when the sensing circuit detects  
4 the presence of the lamp current, the second transistor  
5 being in the first state to discharge the capacitor.

1        11. The discharge lamp circuit as recited in claim 10  
2 wherein the second transistor enters the second state when  
3 the sensing circuit detects the absence of the lamp current,  
4 thereby allowing the capacitor to be charged so that the  
5 node voltage reaches the threshold voltage at the end of a  
6 predetermined period.

1        12. The discharge lamp circuit as recited in claim 11  
2 wherein the start-up circuit generates the start signal at a  
3 second level to shut down the drive circuitry when the  
4 voltage difference drives the first transistor into the  
5 second state for the second transistor being in the second  
6 state.

1        13. The discharge lamp circuit as recited in claim 12  
2 wherein the start-up circuit further comprises a third  
3 transistor coupled to the capacitor, for discharging the  
4 capacitor quickly upon the drive circuitry shutdown.

1        14.A display having functions of ignition time control  
2 and overvoltage protection, comprising:  
3        a discharge lamp; and  
4        a discharge lamp circuit coupled to the discharge lamp,  
5           comprising:  
6           drive circuitry for producing a strike voltage  
7               for the discharge lamp and providing a lamp  
8               current through the discharge lamp;  
9           a sensing circuit for detecting the lamp current;  
10          a timing circuit, controlled by the sensing  
11               circuit, for developing a threshold voltage  
12               at the end of a predetermined period,  
13               thereby controlling an ignition time of the  
14               drive circuitry; and  
15          a start-up circuit for allowing the drive  
16               circuitry to keep on applying the strike  
17               voltage for the ignition time in order to  
18               start the discharge lamp before the  
19               threshold voltage is developed, and for  
20               causing the drive circuitry shutdown if the  
21               sensing circuit detects the absence of the  
22               lamp current.

1        15.The display as recited in claim 14, wherein the  
2 timing circuit comprises a capacitor coupled to a resistor  
3 at a node where a node voltage is developed, in which the  
4 predetermined period is determined by the capacitor's value  
5 and the resistor's value and the node voltage reaches the  
6 threshold voltage at the end of the predetermined period.

1        16. The display as recited in claim 15 wherein the  
2 start-up circuit comprises a first switch coupled to the  
3 node of the timing circuit, receiving an input signal, and  
4 generating a start signal at a first level to activate the  
5 drive circuitry when a voltage difference between the input  
6 signal and the node voltage is sufficient to turn on the  
7 first switch.

1        17. The display as recited in claim 16 wherein the  
2 sensing circuit comprises a second switch coupled to the  
3 capacitor, when the sensing circuit detects the presence of  
4 the lamp current, the second switch is turned on to  
5 discharge the capacitor.

1        18. The display as recited in claim 17 wherein the  
2 second switch is turned off when the sensing circuit detects  
3 the absence of the lamp current, thereby allowing the  
4 capacitor to be charged so that the node voltage reaches the  
5 threshold voltage at the end of a predetermined period.

1        19. The display as recited in claim 18 wherein the  
2 start-up circuit generates the start signal at a second  
3 level to shut down the drive circuitry when the second  
4 switch is turned off, causing the voltage difference to turn  
5 off the first switch.

1        20. The display as recited in claim 19 wherein the  
2 start-up circuit further comprises a third switch coupled to  
3 the capacitor, for discharging the capacitor quickly upon  
4 the drive circuitry shutdown.